S & W CASE 120-001-1

ITEMS MAGNETICALLY CONNECTED THROUGH UNIVERSAL JOINTS

FIELD OF THE INVENTION

The present invention relates generally to magnetic structure, and more particularly to a new and improved structural form and array of a plurality of magnetic components that facilitates the relative disposition of such magnetic components with respect to each other whereby the plurality of magnetic components can be utilized to form any one of various different jewelry items, toys, amusement devices, educational implements, and instructional aids.

BACKGROUND OF THE INVENTION

Magnetic components have of course been used for a considerably long period of time in conjunction with the fabrication, manufacture, or implementation of various different toys, games, amusement devices, and the like, and accordingly, the incorporation of such magnetic components into such toys, games, amusement devices, and the like, has resulted in the inherent demonstration or exhibition of well-known magnetic principles and properties which people invariably or

alternatively find fascinating, amusing, entertaining, instructional, and educational. Recently, magnetic components have been utilized in conjunction with the fabrication and marketing of therapeutic devices, and still further, magnetic components have also been utilized in connection with the fabrication of various different jewelry devices. An embodiment of such a jewelry device is disclosed, for example, in United States Patent **6,427,486** which issued to **Yellen** on August 6, 2002. More particularly, as illustrated within **FIGURE 1**, which substantially corresponds to **FIGURE 1** of the noted patent to **Yellen**, there is disclosed an articulated metal band 20 which is devoid of hooks, pins, clasps, or other fasteners, and which has the form or the configuration of a closed, endless loop 24 so as to effectively define a jewelry bracelet. The endless loop 24 defines a continuous, uninterrupted, repetitive, and endless pattern of magnetically charged cylinders 26 and discs 30, and it is seen that the plurality of discs 30 are arranged within an upper set or layer 38 of discs disposed atop the cylinders 26, and a lower set or layer of discs 40 disposed beneath the cylinders 26. It is noted that the cylinders 26 are magnetized in radial directions oriented at right angles or 90° with respect to the longitudinal axes of the cylinders 26, while the discs 30 are likewise magnetized in the radial directions thereof.

In addition, it is also noted that the cylinders 26 are disposed within a coplanar array, and that adjacent ones of the cylinders 26 tangentially abut each other along linear loci 48. In a similar manner, both the upper and lower set or layers 38,40 of the discs 30 are disposed within coplanar arrays, and it is noted that each one of the plurality of cyl-

inders 26 has a predetermined axial extent or height dimension 32, while each one of the plurality of discs 30 has a predetermined height or thickness dimension 34. Still further, it is noted that both the upper and lower sets or layers 38,40 of the discs 30 are circumferentially offset with respect to the cylinders 26 such that each one of the discs 30, disposed within the upper set or layer 38 of the discs 30, as well as each one of the discs 30, disposed within the lower set or layer 40 of the discs 30, overlies or effectively bridges the linear loci 48 defined between a respective pair 42,42 of adjacent cylinders 26,26 disposed in abutment with each other. Considered still further, it is appreciated that while each one of the discs 30, disposed within the upper set or layer 38 of the discs 30, is coaxially aligned with respect to a respective one of the discs 30, disposed within the lower set or layer 40 of the discs 30, the vertical longitudinal axes of the discs 30 are effectively radially displaced with respect to the vertical longitudinal axes of the cylinders 26 such that the vertical longitudinal axes of the pair of discs 46, comprising a respective one of the upper discs 38 and a respective one of the lower discs 40, are effectively arranged in a colinear manner with respect to the linear loci 48 defining the linear lines along which adjacent ones of the cylinders 26 tangentially abut each other.

While it is noted still further within the aforenoted patent to **Yellen** that the loop 24 of magnetized cylinders 26 and discs 30, comprising the jewelry bracelet, may readily be opened at any selectable juncture defined between any pair of cylinders 26 or discs 30 disposed in contact with each other by manually exerting a predetermined separating

force upon such components, and that the opened loop 24 may likewise be closed, for example, around the wrist of an intended wearer, by simply re-establishing the original magnetic bond forces effectively acting between the band components 26,30, it is to be noted that this may not in fact be the case. It can be appreciated, for example, that the overall structure of the bracelet as disclosed within **Yellen** is substantially complex in that the same comprises the three layers or tiers of components comprising the cylinders 26 and the upper and lower layers 38,40 of discs 30. In addition, it is noted that in view of the fact that each one of the three tiers or layers of components 26,38,40 comprises a plurality of magnetically charged or magnetized components, the magnetic flux or magnetic fields generated by or emanating from the various components will often render the original arrangement of the various components, as illustrated within **FIGURE 1**, relatively unstable and difficult to reassemble or re-establish.

Accordingly, after the loop 24 of magnetized cylinders 26 and discs 30 has been opened at a particular juncture thereof so as to permit the opened loop 24 of magnetized cylinders 26 and discs 30 to be subsequently closed around the wrist of an intended wearer, the magnetic bond forces, which are effectively acting between the cylinder and disc components 26,30, sometimes interact with each other in an unstable or destabilizing manner so as to cause some of the disc components 30 to be moved to undesired positions with respect to the cylinder components 26, thereby effectively preventing the proper closure of the band 20 whereby the bracelet 24 cannot be properly secured around the wrist of the intended

wearer. Still further, as has been previously noted, the magnetized cylinders 26 are disposed in tangential abutment with respect to each other along linear loci 48, and similarly for the discs 30, or considered from another point of view, the magnetized components 26,30 are not universally connected with respect to each other. Accordingly, the cylinders 26 and discs 30 can only be moved linearly along the linear loci 48, and along the similar loci defined between the discs 30, or alternatively, the cylinders 26 and discs 30 can only be rotated around their respective longitudinal axes so as to effectively rollably engage each other along the linear loci 48 or the similar loci defined between the adjacent discs 30. It can therefore be appreciated still further that when the different magnetized components 26,30 are subjected to forces which would tend to move the same in directions which cannot be readily accommodated by means of the lineal tangential abutment defined between the adjacent cylinders and discs 26,30, the cylinders and discs 26,30 will either undesirably separate from each other at undesirable times, or alternatively, the wearer of the bracelet will feel, sense, or be subjected to undesirable constraining forces.

A need therefore exists in the art for a new and improved magnetic structure wherein the structure would be relatively simple to assemble and disassemble, and wherein further, the structure would be comprise a plurality of components which would be magnetically connected together through means of universal connections or joints so as to facilitate the relative disposition of such magnetic components with respect to each other whereby the plurality of magnetic components can be utilized to form any one of various different

jewelry items, toys, amusement devices, educational implements, and instructional aids.

OBJECTS OF THE INVENTION

Accordingly, it is an object of the present invention to provide a new and improved magnetic structure.

Another object of the present invention is to provide a new and improved magnetic structure which comprises a single linear array of a plurality of magnetic components which are magnetically connected together so as to be readily and easily assembled and disassembled with respect to each other.

An additional object of the present invention is to provide a new and improved magnetic structure which comprises a single linear array of a plurality of magnetic components which are magnetically connected together by means of universal joints or connections so as to be readily and easily assembled and disassembled with respect to each other, and wherein the magnetic components can undergo directional movements with respect to each other in accordance with multiple degrees of freedom.

A further object of the present invention is to provide a new and improved magnetic structure which comprises a single linear array of a plurality of magnetic components which are magnetically connected together by means of uni-

versal joints or connections so as to be readily and easily assembled and disassembled with respect to each other, and wherein the magnetic components can undergo directional movements with respect to each other in accordance with multiple degrees of freedom so as to permit the single linear array of the magnetic components to be readily formed into various different jewelry items, toys, amusement devices, educational implements, and instructional aids.

A last object of the present invention is to provide a new and improved magnetic structure which comprises a single linear array of a plurality of primary magnetic components which are magnetically connected together by means of universal joints or connections so as to be readily and easily assembled and disassembled with respect to each other, wherein the magnetic components can undergo directional movements with respect to each other in accordance with multiple degrees of freedom so as to permit the single linear array of the magnetic components to be readily formed into various different jewelry items, toys, amusement devices, educational implements, and instructional aids, and wherein still further, auxiliary ferromagnetic components can be magnetically mounted upon the single linear array of the plurality of primary magnetic components for adornment purposes when the plurality of primary magnetic components are utilized, for example, to form various different jewelry items.

SUMMARY OF THE INVENTION

The foregoing and other objectives are achieved in

accordance with the teachings and principles of the present invention through the provision of a new and improved magnetic structure which comprises a single linear array of a plurality of magnetic components which have spherical configurations and which are magnetically connected together at point loci which therefore define universal joints or connections. In this manner, the magnetic components are readily and easily assembled and disassembled with respect to each other. In addition, in view of the universal joints or connections as effectively constructed at the point loci defined between adjacent ones of the magnetic components, the magnetic components can undergo directional movements with respect to each other in accordance with multiple degrees of freedom. In this manner, the single linear array of the magnetic components is able to be readily formed into various different jewelry items, toys, amusement devices, educational implements, and instructional aids. Still further, auxiliary ferromagnetic components can be magnetically mounted upon the single linear array of the plurality of primary magnetic components, in annular or circumferential arrays defined around the aforenoted point loci, for adornment purposes when the plurality of primary magnetic components are utilized, for example, to form various different jewelry items.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features, and attendant advantages of the present invention will be more fully appreciated from the following detailed description when consid-

ered in connection with the accompanying drawings in which like reference characters designate like or corresponding parts throughout the several views, and wherein:

FIGURE 1 is a perspective view of a conventional, **PRIOR ART** jewelry bracelet comprising a plurality of planar, stacked arrays of magnetized components;

FIGURE 2 is a top plan view of a first embodiment of a new and improved magnetic structure which has been fabricated and formed in accordance with the principles and teachings of the present invention so as to define, for example, a jewelry bracelet, wherein a single linear array of spherically configured, primary magnetic components are magnetically connected together in an articulated manner along point contact loci, and wherein further, a plurality of auxiliary or secondary ferromagnetic components, having spherical configurations which are substantially smaller in diametrical extent than the respective diametrical extents of the primary magnetic components, are magnetically mounted in annular arrays around the point contact loci defined between adjacent ones of the primary magnetic components;

FIGURE 3 is a diagram schematically illustrating how the primary magnetic components of the jewelry bracelet, as disclosed within **FIGURE 2**, can undergo universal movement with respect to each other as considered with respect to three mutually orthogonal axes;

FIGURE 4 is a schematic view showing a pair of primary magnetic components after they are separated from each

other, wherein, in addition, the plurality of auxiliary ferromagnetic components will be disposed in a substantially random string-like array until the pair of primary magnetic components are again brought together at which time the plurality of auxiliary ferromagnetic components will self-align back into their original annular array disposed around the point loci defined between the pair of primary magnetic components disposed in point contact with respect to each other;

FIGURE 5 is a partial top plan view of a second embodiment of a new and improved magnetic structure which has been fabricated and formed in accordance with further principles and teachings of the present invention so as to define, for example, a jewelry bracelet or necklace, wherein the magnetic structure of the second embodiment is slightly different from the magnetic structure of the first embodiment as has been disclosed within **FIGURE 2** in that, in lieu of all of the primary magnetic components being identical to each other, first ones of alternatively arranged primary magnetic components each comprise spherical members, while second ones of alternatively arranged primary magnetic components each comprise substantially cylindrical members having an annular or circumferential recess defined around the axially central region thereof so as to nevertheless provide the second ones of the primary magnetic components with arcuate cross-sectional configurations which thereby preserve and permit the universal movement of any one of a first one of the primary magnetic components with respect to an adjacent one of the second ones of the primary magnetic components; and

FIGURE 6 is a top plan view, similar to that of

FIGURE 2, showing, however, a third embodiment of a new and improved magnetic structure which has been fabricated and formed in accordance with additional principles and teachings of the present invention so as to define, for example, a jewelry bracelet or necklace, wherein the magnetic structure of the third embodiment is slightly different from the magnetic structure of the first embodiment as has been disclosed within **FIGURE 2** in that, in lieu of all of the primary magnetic components being identical to each other, first ones of alternatively arranged primary magnetic components each comprise relatively large diameter spherical members, while second ones of alternatively arranged primary magnetic components each comprise relatively small diameter spherical members.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring again to the drawings, and more particularly to **FIGURE 2** thereof, a first embodiment of a new and improved magnetic structure, which has been fabricated and formed in accordance with the principles and teachings of the present invention, is disclosed and is generally indicated by the reference character 110. More particularly, it is seen that the magnetic structure 110 is seen to comprise a single, continuous, uninterrupted, repetitive linear array of a plurality of primary magnetic components 112 which have been arranged in the form of an endless loop so as to define, for example, a jewelry bracelet. It is further seen that each one of the primary magnetic components 112 has a substantially

spherical configuration wherein opposite ends of each one of the spherically configured primary magnetic components 112 define opposite magnetic poles whereby adjacent ones of the primary magnetic components 112 can be magnetically connected together in an articulated manner along point contact loci as defined by means of the oppositely disposed magnetic poles. More particularly, as disclosed within the schematic drawing of **FIGURE 3**, if the point loci at which adjacent ones of the spherical primary magnetic components 112 touch or abut each other is denoted as 114, then it can be readily appreciated that each one of the spherical primary magnetic components 112 is able to be rotated relative to an adjacent one of the spherical primary magnetic components 112 in a universal manner as considered in connection with the three mutually orthogonal axes X,Y,Z.

Continuing further, and with reference again being made to **FIGURE 2**, it is seen that the magnetic structure 110, which has taken the form of, for example, a jewelry bracelet, further comprises a plurality of auxiliary or secondary ferromagnetic components 116 which are therefore adapted to be magnetically attracted and attached to the primary magnetic components 112,112. Each one of the auxiliary or secondary ferromagnetic components 116 has a spherical configuration, and it is further seen that the auxiliary or secondary ferromagnetic components 116 are arranged within an annular array circumferentially disposed around each one of the point loci 114 at which adjacent ones of the primary magnetic components 112,112 are disposed in engagement or abutment with each other. It is further seen that each one of the auxiliary or secondary spherical ferromagnetic components 116 has a diametri-

cal extent which is substantially less than the diametrical extent of each one of the primary magnetic components 112, and in particular, the diametrical extent of each one of the auxiliary or secondary spherical ferromagnetic components 116 is, at most, one-quarter the diametrical extent of each one of the primary magnetic components 112.

In this manner, each annular array of the auxiliary or secondary spherical ferromagnetic components 116, circumferentially disposed around each one of the point loci 114 defined between adjacent ones of the primary magnetic components 112, comprises nine auxiliary or secondary spherical ferromagnetic components 116. Accordingly, regardless of the actual diametrical extent or dimension of each primary magnetic component 112 or of each auxiliary or secondary ferromagnetic component 116, it is simply important and required to maintain the relative size ratio as defined between the primary magnetic components 112 and the auxiliary or secondary ferromagnetic components. Still further, it is also noted that the diametrical extent D of each one of the annular arrays of the auxiliary or secondary spherical ferromagnetic components 116 is substantially the same as the diametrical extent D of each one of the primary magnetic components 112. In this manner, it can be appreciated that when a person wears the jewelry bracelet 110, the radially inner peripheries of all of the annular arrays of the auxiliary or secondary spherical ferromagnetic components 116 cooperate with the radially inner peripheral surface portions of the plurality of primary magnetic components 112 so as to effectively define a relatively smooth and even radially inner peripheral surface which will not irritate the wearer's skin.

With reference now being additionally made to **FIGURE 4**, when it is desired to, for example, place the jewelry bracelet 110 upon a wearer's wrist, separation forces, oriented in effect in the opposite circumferential directions SFR and SFL, are simply impressed upon any section of the bracelet 110 so as to effectively separate any two adjacent ones of the primary magnetic components 112-S,112-S from each other. When such separation occurs, it will be seen that the plurality of auxiliary or secondary ferromagnetic components 116 will effectively be disrupted or dislodged from their normal annular or circumferential array disposed around the point loci 114, however, due to the magnetic attraction defined between the pair of primary magnetic components 112,112 and the plurality of auxiliary or secondary ferromagnetic components 116, as determined by means of the magnetic field or magnetic flux generated by and emanating from the primary magnetic components 112,112, the plurality of auxiliary or secondary ferromagnetic components 116 will be arranged within different linear or patterned arrays with respect to each one of the separated primary magnetic components 112-S,112-S in accordance with the magnetic field lines.

Subsequently, when the jewelry bracelet 110 is to actually be mounted upon the wearer's wrist, the separated primary magnetic components 112-S,112-S are simply moved closer to each other such that the opposite magnetic poles of the separated primary magnetic components 112-S,112-S cause the separated primary magnetic components 112-S,112-S to be attracted to each other and again be magnetically connected to each other. In conjunction with the re-establishment of the jewelry bracelet 110 as a continuous, uninterrupted, end-

less loop, the auxiliary or secondary ferromagnetic components 116 will effectively automatically realign themselves so as to once again migrate toward and regain their normal or natural annular, ring-like, or circumferential array as depicted within **FIGURE 2**.

With reference now being made to **FIGURE 5**, there is disclosed a second embodiment of a new and improved magnetic structure which has been fabricated and formed in accordance with further principles and teachings of the present invention so as to likewise define, for example, a jewelry bracelet or necklace, and it is seen that the magnetic structure is generally indicated by the reference character 210. It is to be appreciated that the magnetic structure 210 of the second embodiment of the present invention is slightly different from the first embodiment of the magnetic structure 110 of the present invention, as has been disclosed within **FIGURE 2**, in that, in lieu of all of the primary components comprising magnetic components, first ones of alternatively arranged primary components 212 each comprise spherical magnetic members, while second ones of alternatively arranged primary components 213 each comprise spherical ferromagnetic members which have an annular or circumferential recess 215 defined within the outer periphery portion of the axially central region of each one of the second ones of alternatively arranged primary ferromagnetic components 213. As a result of the particularly defined arcuate configuration characterizing the annular or circumferential recess 215, as can best be understood from **FIGURE 5**, it can be further appreciated that the arcuate contour of the annular or circumferential recess 215, as considered in both the X and Y directions, effectively de-

fines a socket which will permit the spherically contoured primary magnetic components 212 to move within the arcuately contoured recessed or socketed regions 215 of the primary ferromagnetic components 213, or alternatively, to permit the primary ferromagnetic components 213 to move relative to the primary magnetic components 212, in a substantially surface-to-surface contact mode as opposed to the point-to-point contact mode characteristic of the first embodiment magnetic structure 110 as disclosed within **FIGURE 2**. Nevertheless, it can be appreciated further that the universal movement of any one of the first primary magnetic components 212, with respect to an adjacent one of the second ones of the primary ferromagnetic components 213, will nevertheless be preserved or permitted.

With reference lastly being made to **FIGURE 6**, there is disclosed a third embodiment of a new and improved magnetic structure which has been fabricated and formed in accordance with still further principles and teachings of the present invention so as to likewise define, for example, a jewelry bracelet or necklace, and it is seen that the magnetic structure is generally indicated by the reference character 310. It is to be appreciated that the magnetic structure 310 of the third embodiment of the present invention is slightly different from the first embodiment of the magnetic structure 110 of the present invention, as has been disclosed within **FIGURE 2**, in that, in lieu of all of the primary magnetic components being identical to each other, first ones, or a first set, of alternatively arranged primary magnetic components 312 each comprise relatively large spherical members, while second ones, or a second set, of alternatively arranged

primary magnetic components 313 each comprise relatively small spherical members. The second ones, or second set, of alternatively arranged primary magnetic components 313 preferably has a diametrical extent D_2 which comprises a predetermined fractional size relative to the diametrical extent D_1 of the first ones, or first set, of alternatively arranged primary magnetic components 312. For example, the second ones, or second set, of alternatively arranged primary magnetic components 313 may have a diametrical extent D_2 which is approximately one-third to one-half of the diametrical extent D_1 of the first ones, or first set, of alternatively arranged primary magnetic components 312.

Other relative or fractional diametrical dimension or ratios are of course possible, and it is also noted that in lieu of the relatively larger and smaller magnetic components 312,313 being alternatively arranged, it is further contemplated that other arrangements of the relatively larger and smaller magnetic components 312,313 are possible. For example, two or more of the larger magnetic components 312 may be disposed adjacent to each other, followed by one or more of the smaller magnetic components 313, or alternatively, two or more of the smaller magnetic components 313 may be disposed adjacent to each other, followed by one or more of the larger magnetic components 312. It is of course to be emphasized and understood further that in view of the fact that all of the primary magnetic components comprising both the first and second sets of primary magnetic components 312,313 have spherical configurations, then all of the particularly arranged primary magnetic components comprising the first set of primary magnetic components 312 and the second set of pri-

mary magnetic components 313 are respectively disposed in point-to-point contact with adjacent ones of the first set of primary magnetic components 312 and the second set of primary magnetic components 313. Accordingly, regardless of the particular arrangement of the first set of primary magnetic components 312 and the second set of primary magnetic components 313, the magnetic and universal movement properties, characteristic of the third embodiment of the new and improved magnetic bracelet structure 310 as disclosed in **FIGURE 6**, are similar to the magnetic and universal movement properties characteristic of the first embodiment of the new and improved magnetic bracelet structure 110 as disclosed in **FIGURE 2**.

While it has been noted that the magnetic structures characteristic of the present invention may comprise, for example, any one of various different jewelry items, toys, amusement devices, educational implements, and instructional aids, it is to be appreciated that when the magnetic structure of the present invention is to comprise a jewelry item, such as, for example, a bracelet, necklace, or the like, each one of the primary magnetic components, as well as each one of the auxiliary or secondary ferromagnetic components, may be provided with suitable decorative or protective coatings. More particularly, the decorative or protective coatings may be suitably colored. For example, considering the bracelet structure 110 as disclosed within **FIGURE 2**, each one of the primary magnetic components 112 may be gold-plated or colored, while each one of the auxiliary or secondary ferromagnetic components 116 may be silver-plated or colored. Of course, other protective coatings, decorative coating, and colors are possible, such as, for example, platinum, copper,

chromium, rhodium, nickel, plastics, enamels, and the like. Of course, it is to also be understood that if the ferromagnetic components are fabricated, for example, from stainless steel, they may not need protective coatings although they may of course be provided with suitable decorative coatings. Still further, and again, when the magnetic structures comprise jewelry items, precious stones, semi-precious stones, and the like, may be integrally or fixedly incorporated within the primary magnetic components.

Thus, it may be seen that in accordance with the principles and teachings of the present invention, there has been disclosed and described a new and improved magnetic structure comprising a linear form or array of a plurality of magnetic components that facilitates the relative disposition of such magnetic components with respect to each other whereby the plurality of magnetic components can be utilized to form any one of various different jewelry items, toys, amusement devices, educational implements, and instructional aids. The magnetic components are connected to each other along point-to-point contact loci, and a plurality of auxiliary or secondary ferromagnetic components may be magnetically attracted and connected to the magnetic components so as to define annular ring-like arrays around the point contact loci. The diametrical extent of the auxiliary or secondary ferromagnetic components is a predetermined fractional amount of the diametrical extent of the primary magnetic components. The magnetic components can be identical in size, or alternatively, two alternating sets of magnetic components can have different diametrical dimensions. Still further, in order to enhance the decorative appearance of the magnetic structures,

particularly when the same comprise jewelry items, the primary magnetic and auxiliary or secondary ferromagnetic components may be provided with suitable, differently colored decorative or protective coatings. Still yet further, first and second sets of primary magnetic and ferromagnetic components may be arranged in a lineal array wherein the ferromagnetic components each have an annular recess or socket defined therein and within which the magnetic components are seated when the ferromagnetic components are magnetically attracted to the magnetic components such that the magnetic and ferromagnetic components can move relative to each other in a universal mode along arcuately curved surface-to-surface loci.

Obviously, many variations and modifications of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described herein.